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  *                                                               *
  *                  W E L C O M E   T O   T H E                  *
  *                                                               *
  *          U. S.   P A T E N T   T E X T   F I L E              *
  *                                                               *
  * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *

=> s (polyester# or copolyester#) and manganese and cobalt? and
titanium and (phosphorous or phosphoric or phosphinic)(w)acid#
        115211 POLYESTER#
          5337 COPOLYESTER#

          46360 MANGANESE
          62553 COBALT?
          98471 TITANIUM
          25495 PHOSPHOROUS
          66635 PHOSPHORIC
           1969 PHOSPHINIC
        379266 ACID#
          58808 (PHOSPHOROUS OR PHOSPHORIC OR PHOSPHINIC)(W)ACID#
L1          582 (POLYESTER# OR COPOLYESTER#) AND MANGANESE AND
COBALT? AND
TIT
                ANIUM AND (PHOSPHOROUS OR PHOSPHORIC OR
PHOSPHINIC)(W)ACID#

=> s l1 and optical(w)brightener#
        215149 OPTICAL
          7509 BRIGHTENER#

          3979 OPTICAL(W)BRIGHTENER#
L2           3 L1 AND OPTICAL(W)BRIGHTENER#

=> s l1 not l2
L3          579 L1 NOT L2

=> s l3 and color?

        267383 COLOR?
L4          345 L3 AND COLOR?

=> s l3 not l4
L5          234 L3 NOT L4

=> d l2 1-3 ab cit

US PAT NO:     5,324,574 [IMAGE AVAILABLE]              L2: 1 of 3

ABSTRACT:
A novel biaxially stretched **polyester** film having excellent
transparency and slipperiness is disclosed. The biaxially
stretched
**polyester** comprises a **polyester** composition which
exhibits a film
haze of not more than 1% after it is made into a film having a
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thickness
of 100 .mu.m and 50-500 ppm on the basis of the weight of monodispersed
cross-linked high polymer particles having an average particle diameter
of 0.8-1.4 .mu.m and exhibits a deformability of 1.2-5.0 in a biaxially
stretched **polyester** film.

1. 5,324,574, Jun. 28, 1994, Biaxially stretched **polyester** film;
Seiji Sakamoto, et al., 428/220, 327, 480, 483 [IMAGE AVAILABLE]

US PAT NO: 5,151,494 [IMAGE AVAILABLE] L2: 2 of 3

ABSTRACT:
The invention is a **polyester** and a method for producing a **polyester** filament which has a combination of flame resistance and
low pilling properties. The method comprises forming a **polyester**
polymer from a mixture consisting essentially of terephthalate acid or
dimethyl terephthalate, ethylene glycol, a chain branching agent having a
functionality of at least 3 and a **phosphinic** **acid** in the amount
between 0.5 and 20 mole percent of the terephthalate acid and monomer. In
particular, the invention also comprises the enhanced fiber formed by the
process, as well as the fabrics having a pilling of about 3 to less than
5 as measured in accordance with ASTM D-3512-82.

2. 5,151,494, Sep. 29, 1992, Flame resistant, low pilling **polyester**
fiber; Jerry T. Munday, et al., 528/287; 524/116, 117, 120, 133, 135, 708
[IMAGE AVAILABLE]

US PAT NO: 5,145,941 [IMAGE AVAILABLE] L2: 3 of 3

ABSTRACT:
The invention is a **polyester** and a method for producing a **polyester** fiber which has a combination of flame resistance and low
properties. The method comprises forming a **polyester** fiber
made from a blend of two **polyester** polymers, one **polyester**
polymer containing an oxysilicon compound and the second **polyester**
polymer containing pentaerythritol and a **phosphinic** **acid**

in the
amount between 0.5 and 20 mole percent of the terephthalate acid and
monomer. In particular, the invention also comprises the enhanced fiber
formed by the process, as well as the fabrics having a pilling of about 3
to less than 5 as measured in accordance with ASTM D-3512-82.

3. 5,145,941, Sep. 8, 1992, Flame resistant, low pilling **polyester**
fiber; Jerry T. Munday, et al., 528/287; 524/116, 117, 120, 133, 135,
708; 525/444; 528/288 [IMAGE AVAILABLE]

=> d l4 1-100 ab cit

=> d l5 1-100 ab cit

=> d l4 30 48 61 93 151 157 158 165 198 208 215 216 218 226 237 238 270 290 294 301 324 ab cit

US PAT NO: 5,385,773 [IMAGE AVAILABLE] L4: 30 of 345

ABSTRACT:
Disclosed is a process for producing **copolyesters** having repeat units
from a dicarboxylic acid component comprising at least 90 mol % terephthalic acid and a glycol component comprising about 10-95 mol %
1,4-cyclo-hexanedimethanol and from about 90-5 mol % ethylene glycol
comprising reacting the dicarboxylic acid component and the glycol
component at temperatures sufficient to effect esterification or transesterification and polycondensing the reaction product in the
presence of a catalyst and inhibitor system consisting essentially of Mn,
Zn, Ti, Ge and P, all parts by weight based on the weight of the **copolyester**.

30. 5,385,773, Jan. 31, 1995, **Copolyester** of cyclohexanenedimethanol
and process for producing such **polyester**; Cheuk C. Yau, et al.,
428/221, 174; 524/115, 431, 432, 440, 706, 779, 783, 785; 528/272, 277,
279, 280, 281, 283, 286, 307, 308.6 [IMAGE AVAILABLE]

US PAT NO: 5,340,907 [IMAGE AVAILABLE] L4: 48 of

345

ABSTRACT:
Disclosed is a process for producing **copolyesters** having repeat units
from a dicarboxylic acid component comprising at least 90 mol % terephthalic acid and a glycol component comprising about 10-95 mol %
1,4-cyclohexanedimethanol and from about 90-5 mol % ethylene glycol
comprising reacting the dicarboxylic acid component and the glycol
component at temperatures sufficient to effect esterification or transesterification and polycondensing the reaction product in the
presence of a catalyst and inhibitor system consisting essentially of Mn,
Zn, Ti, Ge and P, all parts by weight based on the weight of the **copolyester**.

48. 5,340,907, Aug. 23, 1994, **Copolyester** of cyclohexanedimethanol
and process for producing such **polyester**; Cheuk C. Yau, et al.,
528/274; 428/98; 528/272, 279, 280, 281, 286 [IMAGE AVAILABLE]

US PAT NO: 5,286,836 [IMAGE AVAILABLE] L4: 61 of 345

ABSTRACT:
A process for forming **polyesters** that comprises the steps of esterifying a terephthalic acid and an ethylene glycol to produce an
esterification product containing a bis (betahydroxyethyl) terephthalate,
and continuously polycondensing the obtained esterification product to
form a **polyester**. In both the esterifying step and the polycondensing
step, a reaction catalyst consisting of a compound of antimony and a
compound of **titanium** is used. The weight ratio of the compound of
antimony to the compound of **titanium** is 0.01 to 100. The process of
the present invention can considerably reduce both the esterification
time and the polycondensation time and provides good **color**, reduced
diethylene glycol content and reduced condensation of terminal carboxyl
groups in the resulting **polyesters**.

61. 5,286,836, Feb. 15, 1994, Process for forming

polyesters; Sang
S. Park, et al., 528/275, 272, 279, 285 [IMAGE AVAILABLE]

US PAT NO: 5,185,426 [IMAGE AVAILABLE] L4: 93 of 345

ABSTRACT:
A continuous direct esterification and polycondensation process is
disclosed for the production of **polyester** comprising units of ethylene terephthalate as the major repeating units by supplying a slurry
of mainly terephthalic acid and ethylene glycol to bis(betahydroxyethyl)
terephthalate or its oligomer so as to carry out esterification, followed
by polycondensation whereby the resulting oligomer is kept under increasingly reduced pressure, characterized in that a stabilizing
solution of an aliphatic diol containing a diethyl or tributhyl phosphite
and a hindered phenolic phosphonate is added to the reaction mixture
before the start of the polycondensation.

93. 5,185,426, Feb. 9, 1993, Process for the production of **polyester**
with enhanced thermo-oxidative stability; Johannes M. Verheijen, et al.,
528/272; 524/128, 539, 605, 710; 525/437, 444; 528/287, 308.6 [IMAGE
AVAILABLE]

US PAT NO: 4,931,538 [IMAGE AVAILABLE] L4: 151 of 345

ABSTRACT:
The present invention relates to a polyethylene terephthalate based
copolyester modified by aliphatic dicarboxylic acid containing not
less than 9 carbon atoms and poly(tetramethylene oxide)glycol, and to a
polyester resin composition comprising said **copolyester**.
Said **polyester** resin composition exhibits excellent toughness, impact
strength and moldability without harming the inherent characteristics of
polyethylene terephthlate.

151. 4,931,538, Jun. 5, 1990, **Copolyester** and **polyester** resin
composition comprising said **copolyester**; Murata Yoshifumi, et al.,

528/272, 295.3, 300, 302, 303, 304, 308, 308.3, 308.6 [IMAGE AVAILABLE]

US PAT NO: 4,820,795 [IMAGE AVAILABLE] L4: 157 of 345

ABSTRACT:
Disclosed is a **polyester** vessel having mouth, side wall and bottom
portions formed of a **polyester** composed mainly of ethylene terephthalate units, wherein the thermoplastic **polyester** is a **polyester** containing a catalyst residue in an amount smaller than
1000 ppm as the metal, and in the thermoplastic **polyester** constituting the bottom portion of the vessel, the ratio of the thermal
crystallization degree represented by the following formula:

100.times.(Q.sub.DC -Q.sub.AC)/Q.sub.DC (1)
wherein Q.sub.AC stands for the heat quantity of crystallization at
elevation of the temperature and Q.sub.DC stands for the heat quantity of
crystallization at lowering of the temperature, is lower than 90%.

157. 4,820,795, Apr. 11, 1989, **Polyester** vessel and package; Sadao
Hirata, et al., 528/272; 426/106, 113, 118; 528/274, 285, 308.3 [IMAGE
AVAILABLE]

US PAT NO: 4,818,808 [IMAGE AVAILABLE] L4: 158 of 345

ABSTRACT:
A process for producing a linear **polyester** comprising a main structural unit of an aromatic dicarboxylic acid ester of an alkylene
glycol, particularly, comprising a polyethylene terephthalate or polytetramethylene terephthalate unit, is provided. In the process of the
invention, the polycondensation reaction is conducted in the presence of
a niobic acid catalyst that is obtained by heat-treating a hydrated
niobium compound at the temperature range between 80.degree. C. and
400.degree. C. The process of the invention is also effecitvely applied
to the manufacture of an elastomeric **polyester** comprising a polyalkylene terephthalate as a hard segment and a polyalkylene glycol as
a soft segment.

158. 4,818,808, Apr. 4, 1989, Process for producing **polyesters** using a niobium compound as a catalyst; Toshihiro Kushimoto, et al., 528/275; 524/700, 706, 783, 784, 796; 528/277, 279, 283, 286, 308, 308.6 [IMAGE AVAILABLE]

US PAT NO: RE 32,765 [IMAGE AVAILABLE] L4: 165 of 345

ABSTRACT:
A **polyester** which when made into an article such as films, containers, bottles and the like has a very high clarity, a low haze value, and a neutral hue. In the preparation of the resin, an antimony catalyst is utilized along with small amounts of a bluing agent such as a **cobalt** compound and a phosphate compound with the phosphate compound generally being slightly in excess of an equivalent amount of the **cobalt** compound. The **polyester** is made from dicarboxylic acids and preferably aromatic acids such as terephthalic acid reacted with polyhydric alcohols.

165. RE 32,765, Oct. 11, 1988, High clarity **colorless** **polyesters**; Douglas D. Callander, et al., 524/382; 523/100; 524/140, 141, 398, 417, 605 [IMAGE AVAILABLE]

US PAT NO: 4,604,453 [IMAGE AVAILABLE] L4: 198 of 345

ABSTRACT:
A **polyester** having an initial accumulation electric charge of not less than 2.9 .mu.c/mm.sup.2 when determined in a melt state according to the method as hereinabove defined and a heat resistance of not more than 0.210 when determined according to the method as hereinabove defined, which comprises at least one magnesium compound and at least one phosphorus compound solubilized therein in amounts as satisfying the following formulas:

$$30.\text{ltoreq.}[Mg].\text{ltoreq.}400 \quad (1)$$

$$0.8.\text{ltoreq.}Mg/P.\text{ltoreq.}3 \quad (2)$$

wherein [Mg] is the content (ppm) of the magnesium compound in terms of
magnesium atom to the **polyester** and Mg/P is the atomic ratio of the
magnesium atom in the magnesium compound to the phosphorus atom in the
phosphorus compound.

198. 4,604,453, Aug. 5, 1986, **Polyester** composition; Katsuaki Kuze,
et al., 528/481, 275, 276, 279, 280, 286 [IMAGE AVAILABLE]

US PAT NO: 4,535,118 [IMAGE AVAILABLE] L4: 208 of 345

ABSTRACT:
This invention discloses a high clarity, low haze **polyester** having
improved heat-up rates which contains a very small amount of an infrared
absorbent material, such as carbon black. This **polyester** is very
useful as a material for making preforms for trays, containers, and the
like. It is especially useful as a material from which beverage bottles
can be made.

208. 4,535,118, Aug. 13, 1985, High clarity, low haze **polyesters**
having reduced infrared heat-up times; Brian W. Pengilly, 524/398, 399,
417, 435, 496, 605 [IMAGE AVAILABLE]

US PAT NO: 4,501,878 [IMAGE AVAILABLE] L4: 215 of 345

ABSTRACT:
Disclosed is an improved process for the preparation of high molecular
weight linear **polyesters**. In the preparation of **polyesters** by
formation of a bis-dihydroxy ester prepolymer by transesterifying
dimethyl terephthalate with a glycol in the presence of a catalyst
followed by polycondensing the prepolymer in the presence of certain
phosphorous-containing compounds and a transition metal-containing
catalyst which remains active in the presence of said phosphorous
compound, an improved rate of polycondensation is achieved by introducing
the phosphorous compounds after first polycondensing the prepolymer to a

low molecular weight linear **polyester** having an average degree of
polymerization of about 2 to about 10. The improved process further
requires that the catalyst employed in the formation of the prepolymer be
substantially inactive in the presence of said phosphorous compounds.

215. 4,501,878, Feb. 26, 1985, Process for the preparation of high
molecular weight **polyesters**; L. Jane Adams, 528/286, 274, 277, 278,
280, 281, 283, 285 [IMAGE AVAILABLE]

US PAT NO: 4,499,226 [IMAGE AVAILABLE] L4: 216 of 345

ABSTRACT:
A **polyester** which when made into an article such as films, containers, bottles and the like has a very high clarity, a low haze
value, and a neutral hue. In the preparation of the resin, an antimony
catalyst is utilized along with small amounts of a bluing agent such as a
cobalt compound and a phosphate compound with the phosphate compound
generally being slightly in excess of an equivalent amount of the **cobalt** compound. The **polyester** is made from dicarboxylic acids
and preferably aromatic acids such as terephthalic acid reacted with
polyhydric alcohols.

216. 4,499,226, Feb. 12, 1985, High clarity **colorless** **polyesters**; Fred L. Massey, et al., 524/382; 523/100; 524/140, 141,
398, 417, 605 [IMAGE AVAILABLE]

US PAT NO: 4,476,272 [IMAGE AVAILABLE] L4: 218 of 345

ABSTRACT:
A high clarity, low haze **polyester** having improved heat-up rates
contain very small amounts of an infrared absorbent material therein such
as carbon black. Such **polyesters** are used in preforms as for making
trays, etc., and especially in molding operations such as in the blow
molding of beverage bottles.

218. 4,476,272, Oct. 9, 1984, High clarity, low haze **polyesters** having reduced infrared heat-up times; Brian W. Pengilly, 524/398, 417, 435, 496, 605 [IMAGE AVAILABLE]

US PAT NO: 4,454,312 [IMAGE AVAILABLE] L4: 226 of 345

ABSTRACT:
A biaxially stretched **polyester** film comprising a **polyester** and zirconium as an internal particle material, produced by polycondensation of terephthalic acid or its esterified derivative and alkylene glycol as the major essential monomeric components in the presence of a polycondensation catalyst, during which zirconium in the form of any compound thereof in an amount of 80 to 2500 ppm in terms of zirconium atom to the **polyester** as produced being introduced into the reaction system at a stage after the initiation of the reaction and before the intrinsic viscosity of the reaction mixture reaching 0.2, and subjecting the produced **polyester** to film forming.

226. 4,454,312, Jun. 12, 1984, Biaxially stretched **polyester** films; Katsuaki Kuze, et al., 528/275, 272, 274, 279, 283, 285, 286, 308.1, 308.2 [IMAGE AVAILABLE]

US PAT NO: 4,408,004 [IMAGE AVAILABLE] L4: 237 of 345

ABSTRACT:
A high clarity, low haze **polyester** having improved heat-up rates contains very small amounts of an infrared absorbent material therein such as carbon black. Such **polyesters** are used in preforms as for making trays, etc., and especially in molding operations such as in the blow molding of beverage bottles.

237. 4,408,004, Oct. 4, 1983, High clarity, low haze **polyesters** having reduced infrared heat-up times; Brian W. Pengilly, 524/398, 417, 435, 496, 605 [IMAGE AVAILABLE]

US PAT NO: 4,401,804 [IMAGE AVAILABLE] L4: 238 of 345

ABSTRACT:
A process is provided for deactivation of catalyst residues in **polyester** compositions. The **polyester** compositions are provided by polymerizing diols and diacids, or mixtures of such diols and diacids, to form **polyester** compositions. The polymerization is carried out in the presence of a polymerization catalyst that leaves traces of such catalyst residues in the **polyester** composition. These catalyst residues can adversely affect the further processing and end use of the **polyester** composition. The present process provides deactivation of the catalyst residues by the use of a combination of a mono- or dihydrogen phosphonate or mono-, di-, or trihydrogen phosphate compound and a di- or triester phosphonate compound or a phosphite compound.

238. 4,401,804, Aug. 30, 1983, Deactivation of **polyester** catalyst residues; Willis C. Wooten, et al., 528/272, 480, 487 [IMAGE AVAILABLE]

US PAT NO: 4,208,527 [IMAGE AVAILABLE] L4: 270 of 345

ABSTRACT:
In a process for preparing high molecular weight poly-(ethylene terephthalate) in two stages, comprising, in the first stage, reacting a dialkyl ester of terephthalic acid with ethylene glycol in the presence of 35 to 290 ppm of **manganese**, in the form of a **manganese**-II salt effective as a catalyst, together with 6 to 95 ppm of **cobalt**, in the form of a **cobalt**-II salt effective as a catalyst, at a temperature of 170.degree. to 220.degree. C. to give a low molecular weight precondensate; then adding 45 to 140 ppm of phosphorus in the form of a phosphorus compound effective to minimize discoloration of the product poly-(ethylene terephthalate) due to said transesterification catalysts; and, in the second stage, effecting complete condensation of the

precondensate thus obtained, in the presence of catalysts at a temperature of 270.degree.-290.degree. C. and under low pressure, to give high molecular weight poly-(ethylene terephthalate), an improvement is provided wherein, in the second stage, 115 to 230 ppm of germanium, in the form of a germanium-IV salt effective as a catalyst, and 2 to <20 ppm of **titanium**, in the form of a **titanium**-IV salt effective as a catalyst, all quantity data for the catalyst components being based on the weight parts of terephthalic acid units, are added to the reaction mixture as the catalysts.

270. 4,208,527, Jun. 17, 1980, Process for the manufacture of high molecular weight poly-(ethylene terephthalate); Gernot Horlbeck, et al., 528/279, 283, 286, 308.5 [IMAGE AVAILABLE]

US PAT NO: 4,131,601 [IMAGE AVAILABLE] L4: 290 of 345

ABSTRACT:
A process for the preparation of substantially linear, highly polymerized **polyesters** by polycondensing a glycol ester of an aromatic dicarboxylic acid and/or a low molecular weight condensate thereof, the process being characterized by using as a polycondensation catalyst a preformed titanate compound obtained by reacting a titanic acid ester represented by the formula Ti(OR).sub.4, where R is an alkyl group having from 1 to 5 carbon atoms, with an aromatic acid selected from the group consisting of trimellitic acid, trimellitic anhydride, hemimellitic acid, hemimellitic anhydride or a mixture of one or more thereof at a molar ratio of from about 0.5 to about 2.5 mols of the aromatic acid per 1 mol of the titanic acid ester, to thereby form **polyesters** which have a high softening point and good **color** tone. SU

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to a process for the preparation of **polyesters**, in particular, to a process for the preparation of

substantially linear, highly polymerized aromatic **polyesters** having a high softening point and good **color** tone.

2. Description of the Prior Art

Polyesters obtained by reacting an aromatic dicarboxylic acid with a glycol have excellent mechanical, physical and chemical properties, and hence are widely used for fiber, film and other moulding materials. Among such **polyesters**, **polyesters** obtained by reacting an acid component consisting mainly of terephthalic acid with a glycol component selected from the group consisting of ethylene glycol, tetramethylene glycol, hexamethylene glycol and cyclohexane-1,4-dimethanol are especially important.

In manufacturing the aforesaid **polyesters**--e.g., polyethylene terephthalate, conventional processing consists of heating the ethylene glycol ester of terephthalic acid and/or a low molecular weight condensate thereof under reduced pressure to effect polycondensation. In carrying out the polycondensation reaction on a commercial scale, catalysts are used to accelerate reaction. The rate of polycondensation and the qualities of the resulting **polyester** are greatly influenced by the kind(s) of catalyst(s) used.

Titanium compounds are known as excellent catalysts for the above-described polycondensation reaction.

For example, U.S. Pat. No. 2,822,348, Haslam, issued Feb. 4, 1958, discloses tetraisopropyltitanate, and British patent specification No. 793,111 to I.C.I. Limited, published Apr. 9, 1958, discloses an organic titanate, such as tetramethyl titanate and tetrabutyl titanate as a catalyst in the polycondensation reaction.

Although **titanium** compounds result in a very rapid rate of polycondensation, they also result in the formation of **polyesters** having a distinctly yellow **color** and provide **polyesters** with a decreased softening point. Methods have also been proposed to avoid the

disadvantage of yellowness in **polyesters** formed as described.

For example, British Pat. No. 949,085 to I.C.I. Limited, published Feb. 12, 1964, discloses the use of a catalyst system which is the combination of a germanium compound (such as germanium tetraethoxide) and a **titanium** compound (such as **titanium** tetraisopropoxide or **titanium** tetrabutoxide) whereby the disadvantage of yellowness in the resulting **polyester** is considerably reduced. However, the rate of polycondensation is also reduced as compared to the use of a **titanium** compound alone. Further, this catalyst system is difficult to store for extended times because **titanium** compounds, such as **titanium** tetraisopropoxide or **titanium** tetrabutoxide, easily lose catalytic activity in the presence of a small amount of water.

British Pat. No. 851,061 to Goodyear Tire & Rubber Co., published Oct. 12, 1960, discloses the use of preformed organic titanate compounds formed by the rection of titanic acid esters with polyhydroxy compounds, such as ethylene glycol lor tetramethylene glycol, polycarboxylic compounds, such as maleic acid, phthalic acid and trimesic acid, or hydroxy carboxylic compounds, such as lactic acid and hydroxy benzoic acid. In the preparation of **polyesters**, these preformed organic titanate compounds accelerate the rate of polymerization and permit the formation of polymers of high molecular weight. However, as a result of experiments performed by the present inventors, it was found that the preformed organic titanate compounds disclosed in this British patent do not fully overcome the disadvantage of yellowness of the obtained **polyesters** so as to provide a **color** tone suitable for commercial use. In addition, for example, the preformed organic titanate compound derived from phthalic acid does not sufficiently accelerate the rate of polymerization. Finally, it is difficult to uniformly react trimesic acid (benzene-1,3,5-tricarboxylic acid) with a titanic acid ester.

SUMMARY OF THE INVENTION

It has now been surprisingly found that if a preformed titanate compound obtained by reacting a titanic acid ester with an aromatic tricarboxylic acid having the capacity to form an anhydride is used as a catalyst in the polycondensation of an aromatic dicarboxylic acid with a glycol to form a **polyester**, the above-mentioned disadvantages of the prior art can be substantially overcome.

It is, therefore, one object of the present invention to provide a process for the preparation of substantially linear, highly polymerized **polyesters** having a high softening point and good **color** tone.

It is another object of the present invention to provide a process for the preparation of **polyesters** using a polycondensation catalyst which is easily obtained and storable for extended periods of time without degradation.

The above-mentioned objects are attained by the process for the preparation of **polyesters** in accordance with the present invention, which comprises polycondensing a glycol ester of an aromatic dicarboxylic acid and/or a low molecular weight condensate thereof while removing glycol therefrom in the presence of a polycondensation catalyst which is preformed titanate compound obtained by reacting a titanic acid ester represented by the formula Ti(OR).sub.4, where R is an alkyl group having from 1 to 5 carbon atoms, with an aromatic acid selected from the group consisting of trimellitic acid (benzene-1,2,4-tricarboxylic acid), trimellitic anhydride, hemimellitic acid (benzene-1,2,3-tricarboxylic acid), hemimellitic anhydride or a mixture of one or more thereof.

290. 4,131,601, Dec. 26, 1978, Process for the preparation of **polyesters**; Satoshi Hashimoto, et al., 528/279, 308 [IMAGE AVAILABLE]

US PAT NO: 4,115,371 [IMAGE AVAILABLE] L4: 294 of 345

ABSTRACT:
A process for the production of high molecular weight low **color** polyethylene terephthalates using a particulaarly effective polycondensation catalyst is disclosed. **Titanium** tetrabutylate is added to the reaction mixture after the initial esterification or transesterification reaction is about 95% complete and the polycondensation is completed at temperatures between about 200 and 270.degree. C under reduced pressure. Metaphosphoric acid or its alkali or alkaline earth metal salts are added with the **titanium** tertrabutylate to control the **color**. Commonly accepted catalysts may be employed for the initial esterification or transesterification. Polymers with intrinsic viscosities in excess of 0.7 dl/g and yellowness numbers less than 6 can be produced.

294. 4,115,371, Sep. 19, 1978, Stabilization of polycondensates of polyethylene terephthalate; Peter Bier, et al., 524/605; 528/275, 279, 286 [IMAGE AVAILABLE]

US PAT NO: 4,096,122 [IMAGE AVAILABLE] L4: 301 of 345

ABSTRACT:
A process for producing a linear **polyester** which comprises:
(1) condensing excess 1,4-butanediol with a lower alkyl ester of an aromatic dicarboxylic acid at a temperature of less than 200.degree. C;
(2) removing uncondensed 1,4-butanediol therefrom so that the reaction mixture contains no more than 1% by weight 1,4-butanediol;
(3) condensing the so-formed dicarboxylic acid-bis-(4-hydroxy butyl ester) and any oligomer thereof with a dicarboxylic acid at a temperature of 200 to 250.degree. C, the dicarboxylic acid being present in no more than a stoichiometric amount; and
(4) polycondensing the resultant condensate by heating the same at between 250.degree. and 310.degree. C in a vacuum.

301. 4,096,122, Jun. 20, 1978, Process for the production of

polyesters of 1,4-butanediol; Gerhard Schade, et al., 528/278, 275,
276, 280, 283, 286, 302, 304, 305 [IMAGE AVAILABLE]

US PAT NO: 3,951,886 [IMAGE AVAILABLE] L4: 324 of 345

ABSTRACT:
A process for producing **polyester** resins, such as saturated **polyester** resin, alkyd resin and unsaturated **polyester** resin from
polyester wastes, which comprises depolycondensing **polyester**
wastes with at least one polyol in the presence of at least one titanyl
oxalate compound and/or **titanium** tartrate compound and subsequently
polycondensing the resulting depolycondensation product with at least one
polycarboxylic acid or its anhydride or with at least one polycarboxylic
acid or its anhydride and at least one polyol, optionally in the presence
of at least one phosphorus compound.

324. 3,951,886, Apr. 20, 1976, Process for producing **polyester**
resin; Hideo Miyake, et al., 521/48.5; 528/279; 560/80, 83, 89, 120, 127,
198 [IMAGE AVAILABLE]

=> d l5 22 36 ab cit

US PAT NO: 5,302,686 [IMAGE AVAILABLE] L5: 22 of 234

ABSTRACT:
A hollow article or sheet of a **copolyester** which comprises, as main
components, terephthalic acid as a dicarboxylic acid component and
ethylene glycol as a diol component and which is characterized by:
(1) isophthalic acid as a dicarboxylic acid component being from 0.5 to
3.0 mol %,
(2) diethylene glycol as a diol component being from 1.0 to 2.5 mol %,
(3) the intrinsic viscosity being from 0.60 to 1.50 dl/g,
(4) the concentration of terminal carboxyl groups being at most 18
eq/ton, and
(5) the content of a cyclic trimer being at most 0.40% by weight.

22. 5,302,686, Apr. 12, 1994, Hollow container and stretched film made
of a **copolyester**; Katsuji Tanaka, et al., 428/35.7; 264/209.1, 291,
294; 428/34.1; 528/272, 283, 285, 302, 305, 308.6, 481, 503 [IMAGE
AVAILABLE]

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ABSTRACT:
A **copolyester** which comprises, as main components, terephthalic acid
as a dicarboxylic acid component and ethylene glycol as a diol component
and which is characterized by:
(1) isophthalic acid as a dicarboxylic acid component being from 0.5 to
3.0 mol %,
(2) diethylene glycol as a diol component being from 1.0 to 2.5 mol %,
(3) the intrinsic viscosity being from 0.60 to 1.50 dl/g,
(4) the concentration of terminal carboxyl groups being at most 18
eq/ton, and
(5) the content of a cyclic trimer being at most 0.40% by weight.

36. 5,262,513, Nov. 16, 1993, **Copolyester**, and hollow container and
stretched film made thereof; Katsuji Tanaka, et al., 528/272; 428/34.1,
364, 480; 528/283, 284, 302, 308, 308.6 [IMAGE AVAILABLE]

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